formed together, or in other words, that one atom of rubian, by its decomposition, gives rise to all five at the same time; but that, from the composition of these substances as compared with that of rubian, it follows, that the decomposition affects three separate atoms of rubian. One of these atoms loses 14 atoms of water, and is converted into alizarine. The second loses 12 atoms of water, and then splits up into verantine and rubiretine. The third takes up the elements of water, and then splits up into rubianine and sugar. Whether it would be possible to confine the decomposition of rubian entirely to one of these processes, or whether all three are essential, he considers is a question of the highest importance, not so much in a theoretical as in a practical point of view; and that should any chemist succeed in changing rubian entirely into alizarine, he would be the means of giving a great stimulus to many branches of manufacture and adding largely to the national wealth.

February 20, 1851.

LIEUT.-COL. SABINE, V.P. and Treas., in the Chair.

The Chairman stated, that Mr. John Scott Russell, who ceased at the last Anniversary to be a Fellow of the Society in consequence of the non-payment of his subscription, had applied to the Council to be reinstated, alleging that his numerous avocations and absence from England caused him to overlook the fact of his subscription not having been paid. The Chairman therefore gave notice, that, in accordance with the statutes, the question of the readmission of Mr. Russell into the Society would be put to the vote at the ensuing meeting.

A paper was in part read, entitled "On Periodical Laws discoverable in the mean effects of the larger Magnetic Disturbances," by Lieut.-Col. Sabine, V.P. and Treas. R.S., &c.

February 27, 1851.

SIR FREDERICK POLLOCK, Lord Chief Baron, V.P., in the Chair.

The question of Mr. J. S. Russell's re-admission into the Society was put to the vote and carried.

Lieut.-Colonel Sabine's paper, entitled "On Periodical Laws discoverable in the mean effects of the larger Magnetic Disturbances," was concluded.

In a discussion of the *two-hourly* observations of the magnetic declination, made in 1841 and 1842 at the observatories of Toronto and Hobarton, published in 1843 and 1845, the author expressed an opinion that the magnetic disturbances, of large amount and apparently irregular occurrence, commonly called magnetic storms or shocks,

would be found, when studied in their mean effects on the magnetic direction and force extending over a sufficient period of time, to be subject to *periodical laws*, connecting them with the seasons of the year and the hours of the day at the particular stations.

In preparing for the press the *hourly* observations of the declination in the years 1843, 1844 and 1845, at the same two stations, the author found his previous opinions strongly confirmed; and believing that the evidence thus obtained of periodical laws is far too systematic, and rests on a series of too long duration to make it probable that it will be otherwise than confirmed by the continuation of the observations in subsequent years, he has been induced to make it the subject of a communication to the Royal Society; although it is probable that the exact periods, and the mean numerical values of the effects produced, or their proportions to each other in the different seasons and at the different hours, may hereafter receive modifications.

The disturbances which are the subject of this investigation have two leading characteristics,—1st, the irregularity of their occurrence, many days together frequently passing without any trace of them being discoverable; and 2nd, the large amount of deviation from a mean or normal position, to which the needle is subject during their continuance. It is this last feature which has led to their general recognition, and to the establishment of the fact, that when they take place their influence usually extends simultaneously, or nearly so, over all parts of the globe at which observations have been made. The same feature still affords their best and most convenient distinguishing mark.

Availing himself of this characteristic, the author separated from the whole mass of hourly observations in the three years at both stations a sufficient portion of disturbed observations to form an adequate basis for investigation. The portion thus separated consisted at Toronto of the 1650 largest deviations of the declination magnet from its mean position; the whole number of hourly observations in the same period being 22,376, and the proportion therefore being 1 in 13·6; and at Hobarton of the 1479 largest deviations, the whole number being 21,436, and the proportion 1 in 14·5. Of the 1650 disturbed observations at Toronto, 472 were in 1843, 612 in 1844, and 566 in 1845. Of the 1479 disturbed observations at Hobarton, 415 were in 1843, 562 in 1844, and 502 in 1845. Whence it appears, that at both stations, situated as they are in opposite hemispheres and nearly at opposite points of the globe, 1843 was the least disturbed year of the three, and 1844 the most so. Taking the number in 1845 as unity, the numerical proportions at each station are as follows:—

	Toronto.	Hobarton.
1843.....	0·84	0·83
1844.....	1·08	1·12
1845.....	1·00	1·00

This accordance, and the fact that the separated disturbed observations in these years occurred for the most part on the same days at

the two stations, are noticed as corroborating the conclusions, derived from former investigations, of the character of these disturbances as affecting contemporaneously the most distant parts of the globe.

Several tables are given containing the distribution of the separated observations,—1st, into the several *months*, and 2nd, into the several *hours*, of their occurrence, the hours being those of local time. This is done, first, in regard to the *number* of disturbed observations in the several months and hours; a separate account being taken of those which are easterly, and of those which are westerly deflections; and second, in regard to the *mean numerical values* of the deflections at the different hours, distinguishing easterly and westerly, and taken on a daily average throughout the year. The results of this analysis are carefully stated; and are conclusive, in the author's opinion, in manifesting the existence of periodical laws in the times of occurrence and in the effects of the larger disturbances; these laws having points of remarkable analogy at both stations, and showing a causal connexion to subsist between the disturbances on the one hand, and the seasons of the year and hours of the day on the other.

The author remarks on the practical bearing which the establishment of such laws must have on the researches, which have been recently brought before the Royal Society by one of its most distinguished members, into the physical causes of the periodical variations of terrestrial magnetism, particularly of the *diurnal* magnetic variation. The present investigation shows that the latter phenomenon must now be regarded as consisting of *two* periodical variations, superimposed upon each other, having extremely dissimilar laws, and probably therefore different immediate causes. These constituent parts of the variation will bear different proportions to each other in different parts of the globe, and in many parts of the globe it will be necessary, in the author's opinion, to separate the whole diurnal variation into its constituents in order to study their respective physical causes. At Toronto and Hobarton the diurnal variation occasioned by the disturbances forms a clearly recognizable part of the whole diurnal variation; the greater part, if not the whole of that remarkable phenomenon, which Mr. Faraday has termed the "nocturnal episode," appearing to be attributable to this cause.

The author concludes by remarking, that the investigation which forms the subject of this paper cannot be regarded as complete, until the influence of the larger disturbances on the phenomena of the magnetic *inclination* and *force* have undergone a similar examination. This he hopes to have a future opportunity of submitting to the Society.